

The Navy Coupled Ocean Data Assimilation (NCODA) system in HYCOM

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<http://www.hycom.org>

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Atlantic near real-time system

- 1/12° Atlantic (28°S to 70°N)
- Running in near real-time (on Wednesday)
 - . Assimilates the satellite altimeter analysis from the MODAS operational system at the Naval Oceanographic Office (NAVOCEANO)
 - . Mean SSH from the 1/12° MICOM (ECMWF)
 - . Vertical projection via the Cooper and Haines technique (1996, JGR)
 - . FNMOC/NOGAPS atmospheric forcing
 - . Relaxation to the MODAS SST analysis
- 10 day hindcast, 14 day forecast
- Provide boundary conditions for coastal models

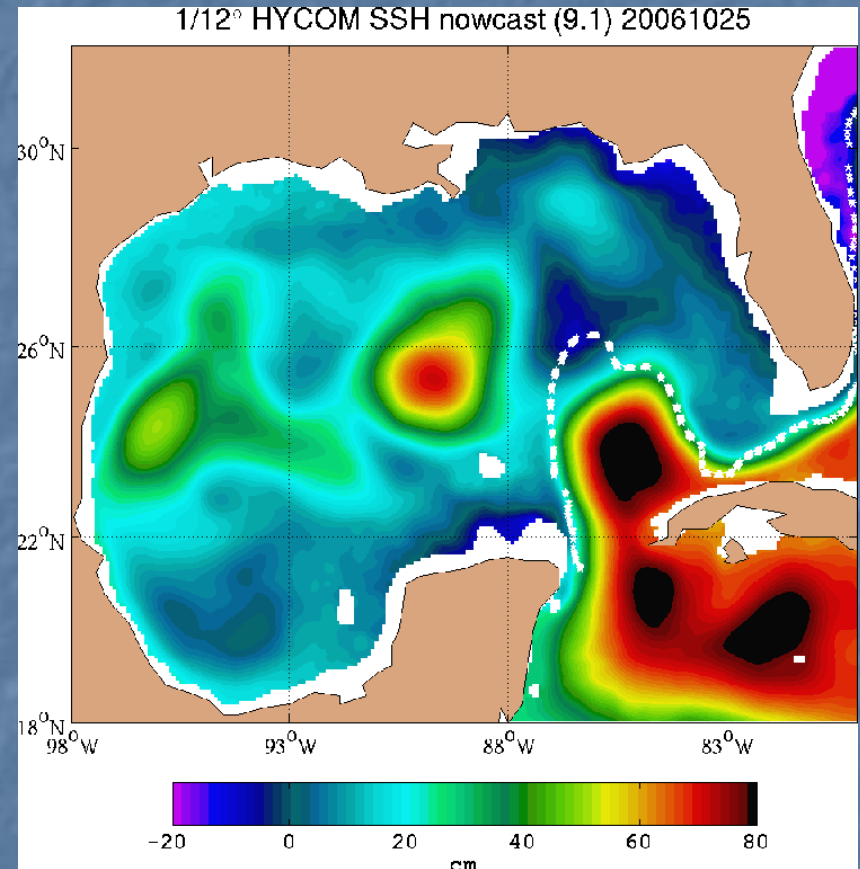
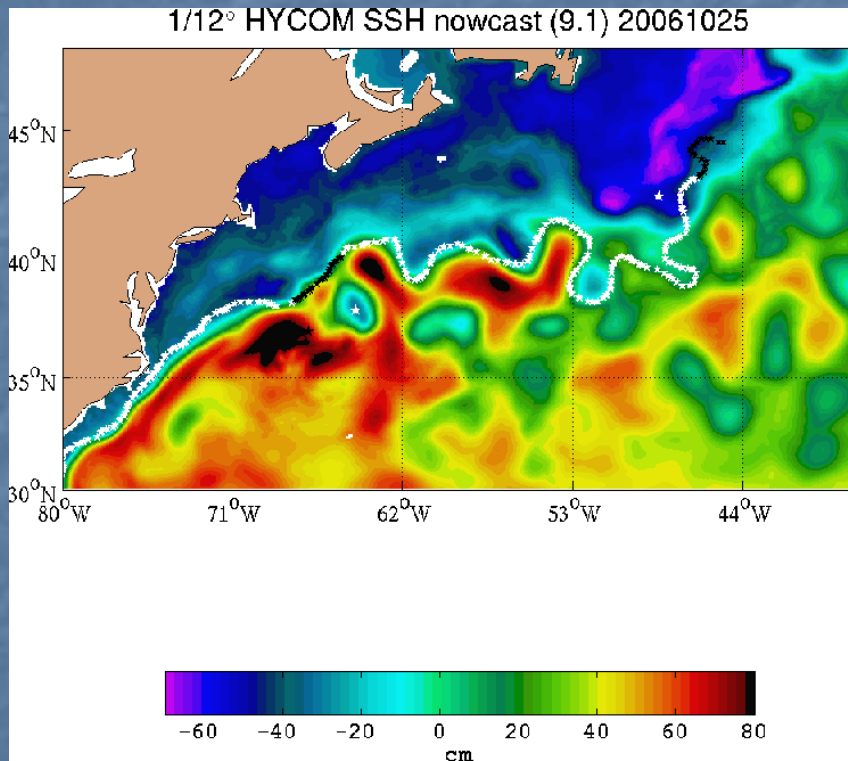
<http://www7320.nrlssc.navy.mil/ATLhycom1-12/skill.html>

<http://www.hycom.org>

1/12° Atlantic HYCOM

SSH in Gulf Stream and Gulf of Mexico region

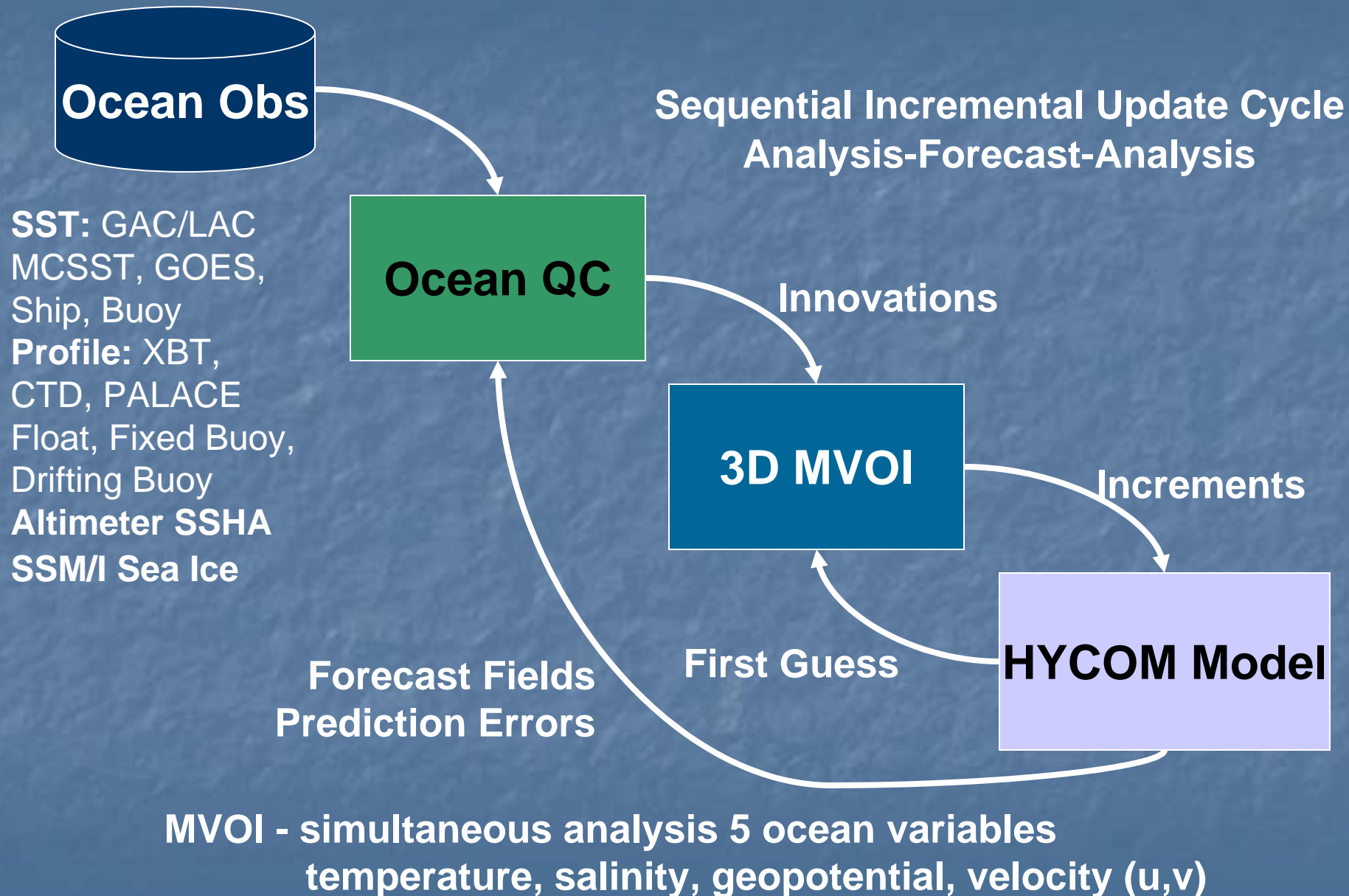
25 October 2006



White/black line is the frontal analysis of MCSST observations performed at NAVOCEANO. Black line represents data more than four days old.

<http://www.hycom.org>

Navy Coupled Ocean Data Assimilation (NCODA)



HYCOM/NCODA coupling

- HYCOM to 3D z-grid
- NCODA analysis on z-grid
- Use the NCODA analysis in an incremental updating of the HYCOM variables.
- Daily NCODA analysis

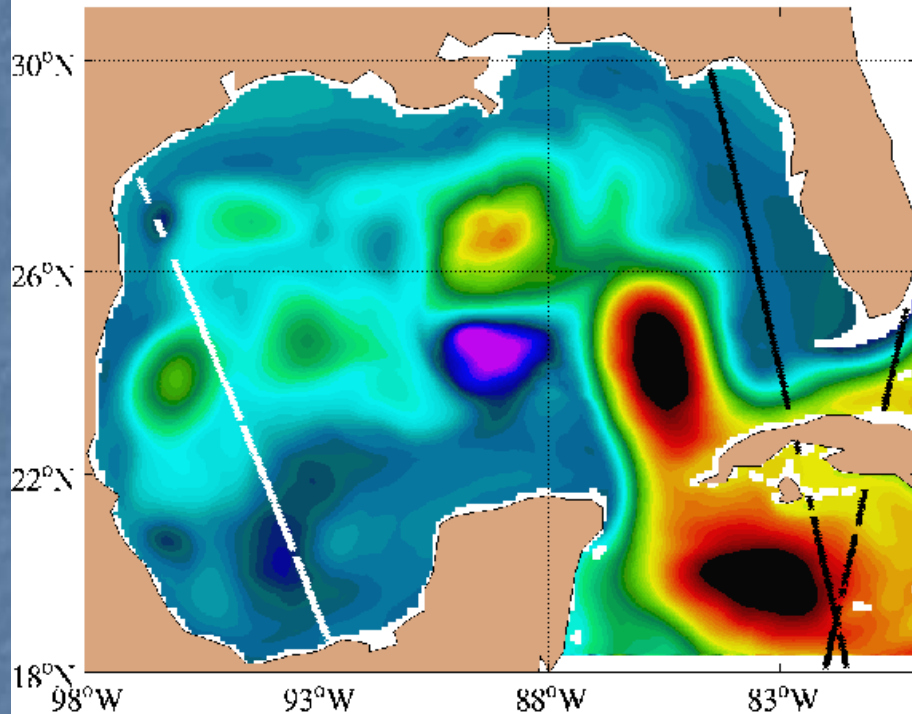
1/12° GULF OF MEXICO HYCOM CONFIGURATION

- Horizontal grid: 1/12° (258 x 175 grid points, 6.5 km spacing on average)
- 18°N to 31°N
- 20 vertical coordinates
- Bathymetry: 5m coastline
- Surface forcing from FNMOC/NOGAPS
- Monthly river runoff
- Nested Boundary:
relaxation to the 1/12° Atlantic HYCOM T, S, U and V along open boundary, (no assimilation in these experiments)

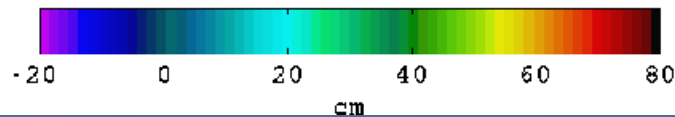
HYCOM identical twin SSH and SST data

Ocean model sampled
along observed tracks

1/12° HYCOM SSH noassim (0.0) 19990825

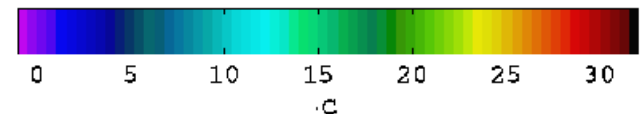
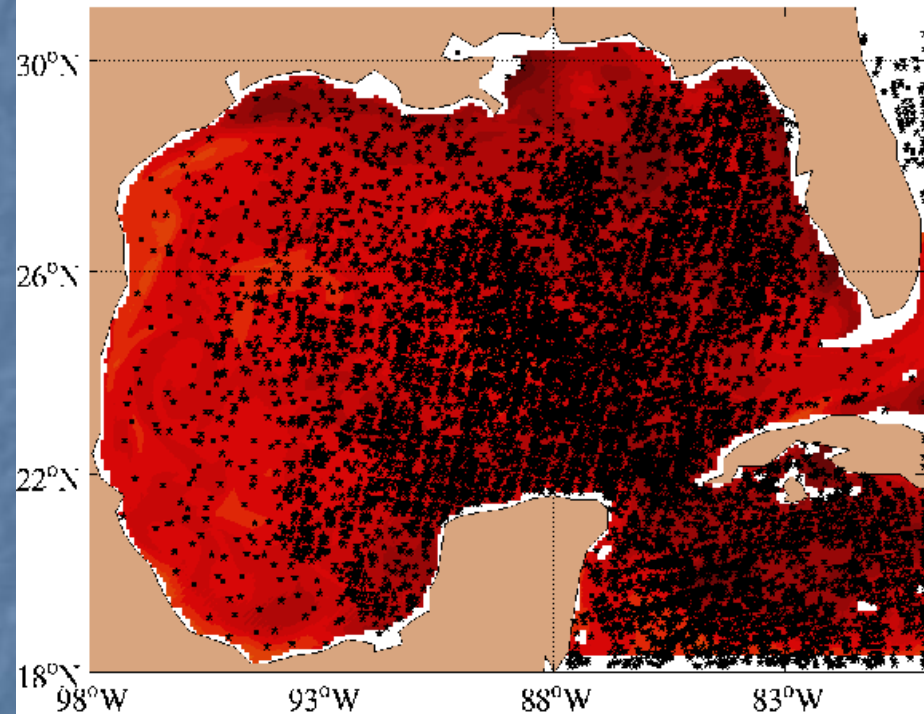


TOPEX - white ERS2 - black



Model sampled at observed
MCSST locations

1/12° HYCOM SSH noassim (0.0) 19990825

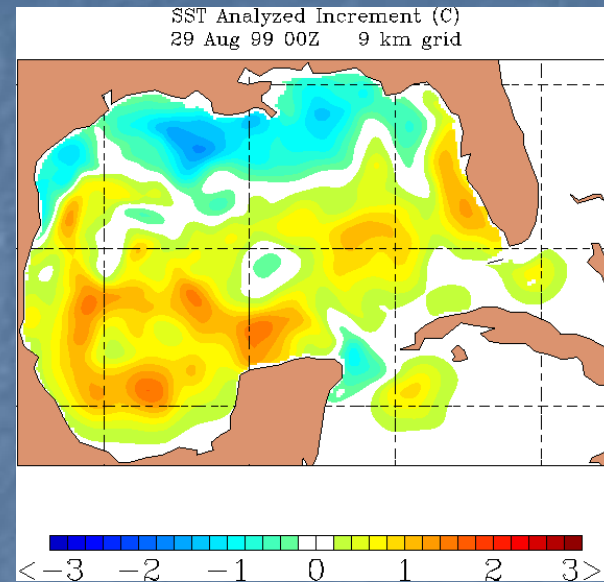
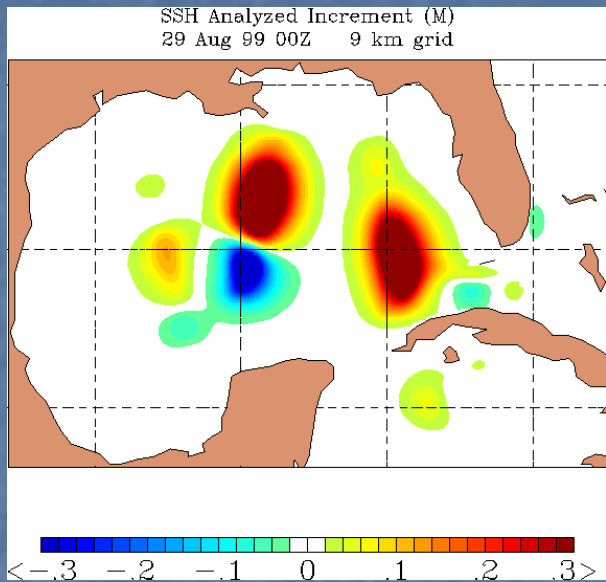


HYCOM identical twin results

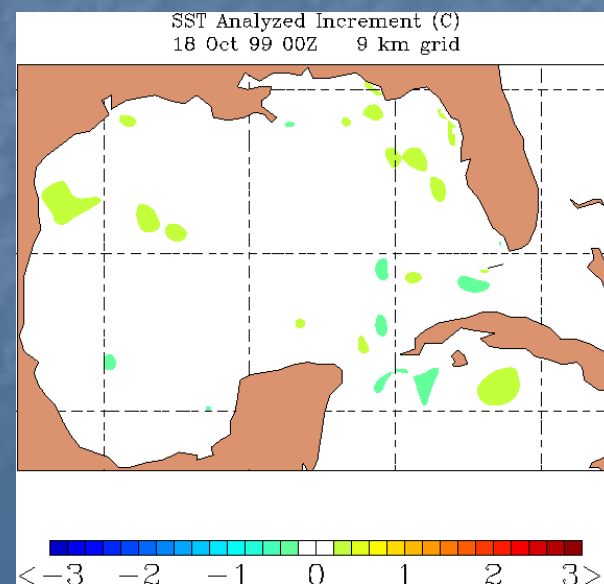
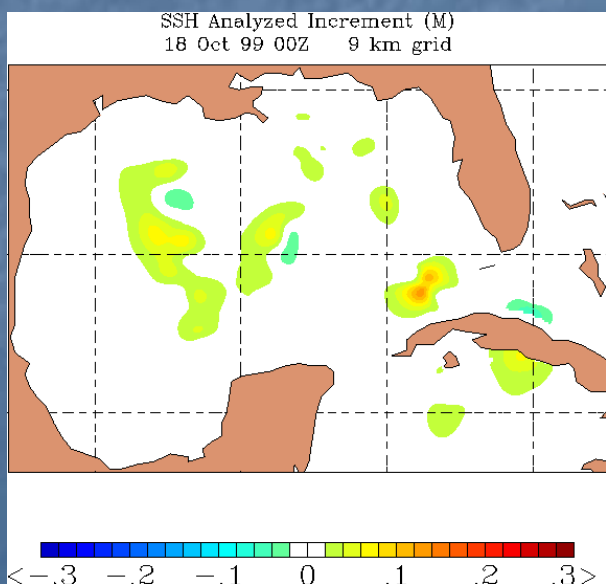
“Observed” track and MCSST locations

SSH ← increments → SST

29 August 1999
Day 1



18 October 1999
Day 50



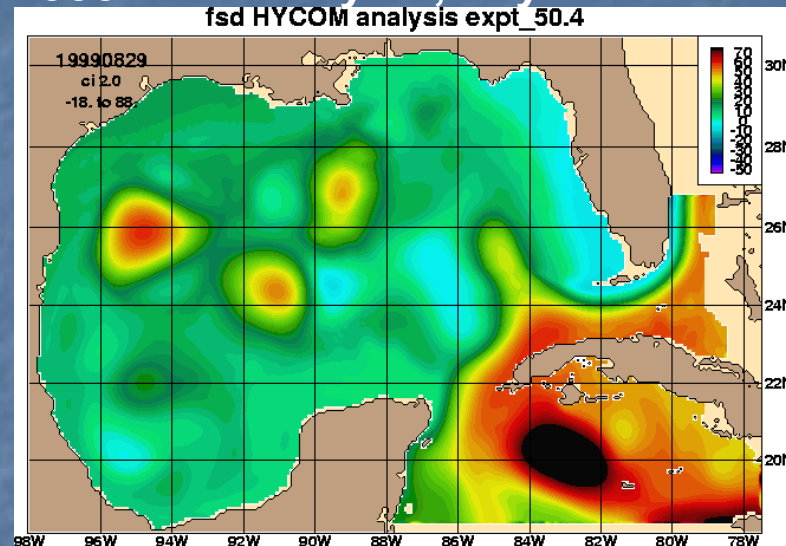
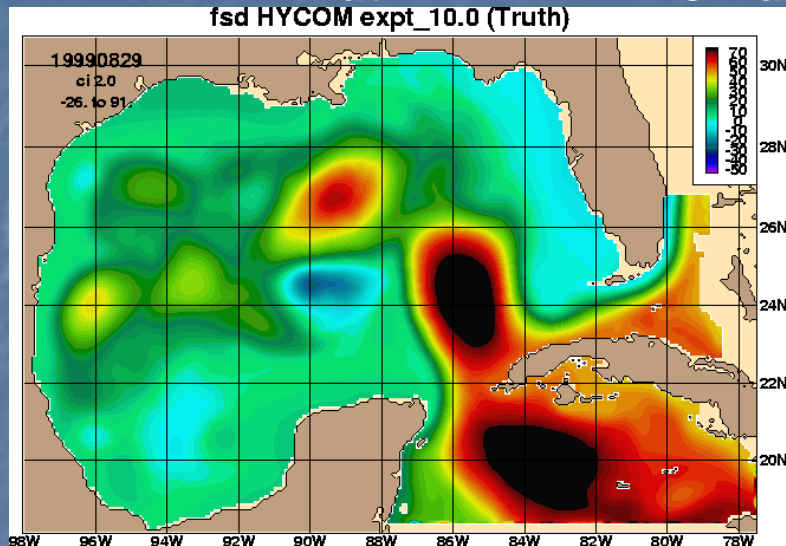
HYCOM identical twin results

“Observed” track and MCSST locations

Truth

29 August 1999

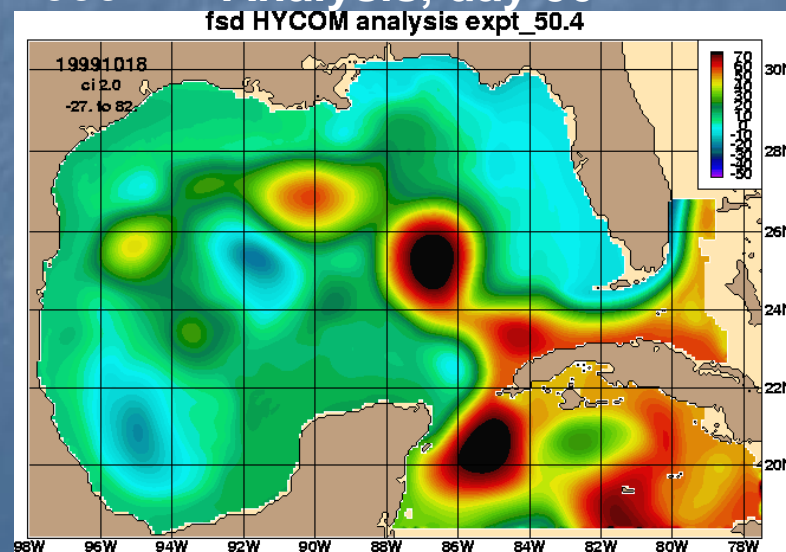
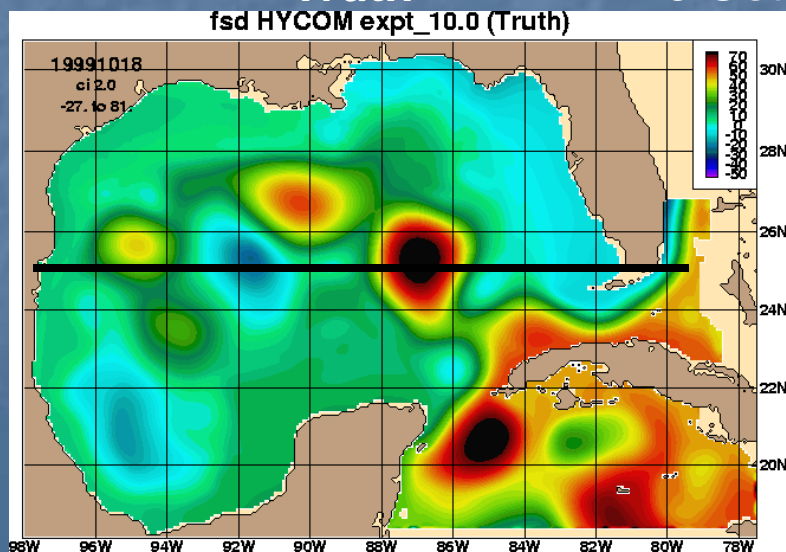
Analysis, day 1



Truth

18 October 1999

Analysis, day 50

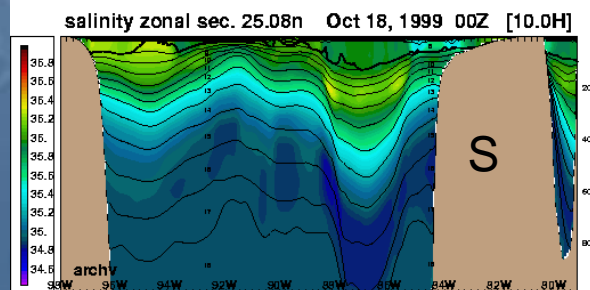
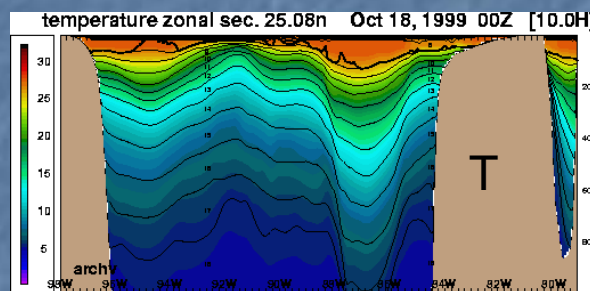
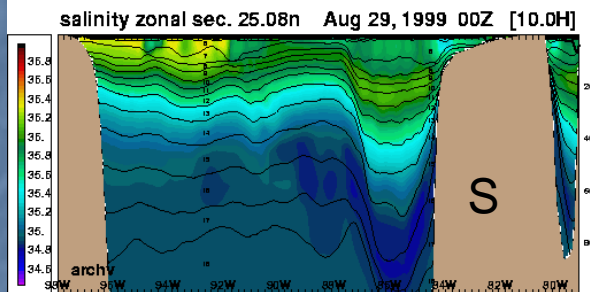
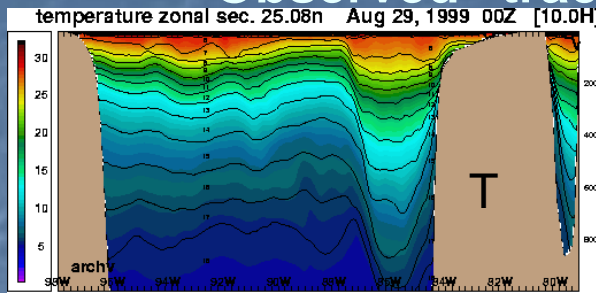


HYCOM identical twin results

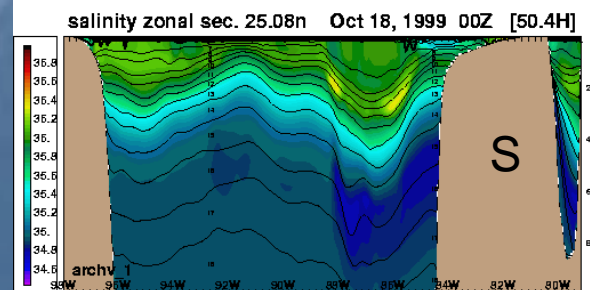
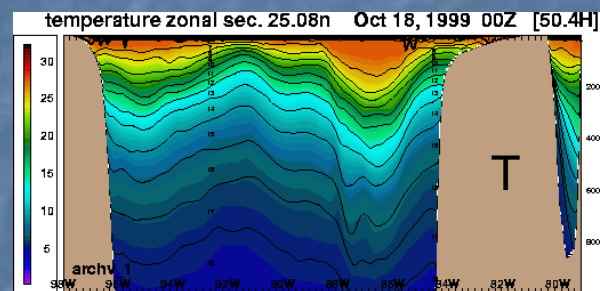
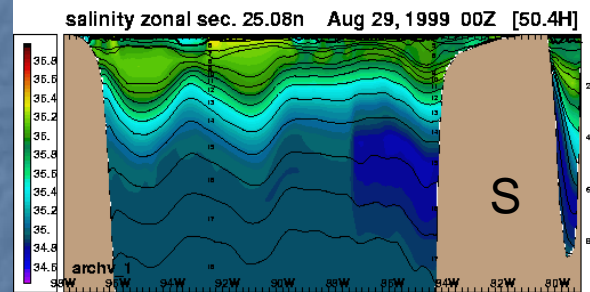
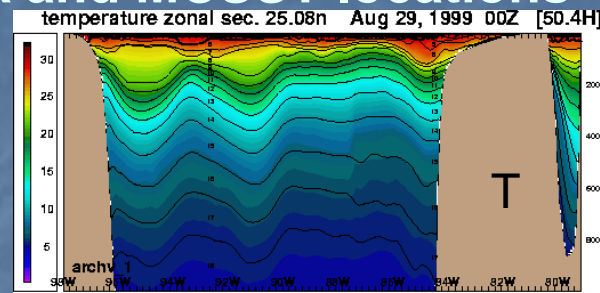
Temperature and salinity sections along 25.08°N

“Observed” track and MCSST locations

Truth



Truth



Analysis, day 1
29 August 1999

Analysis, day 50
18 October, 1999

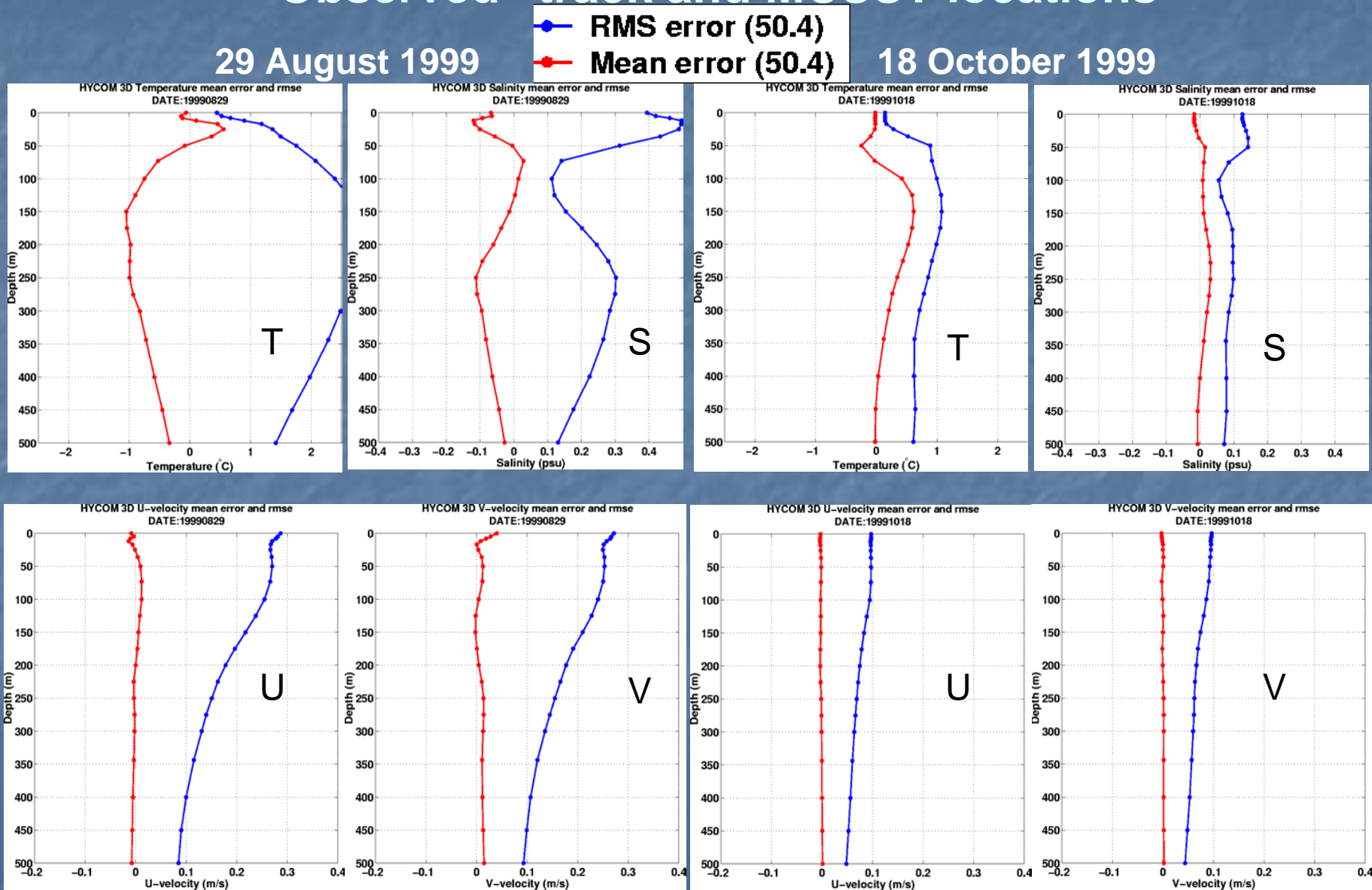
HYCOM identical twin results

RMSE vertical profiles (0-500m)

“Observed” track and MCSST locations

29 August 1999

18 October 1999



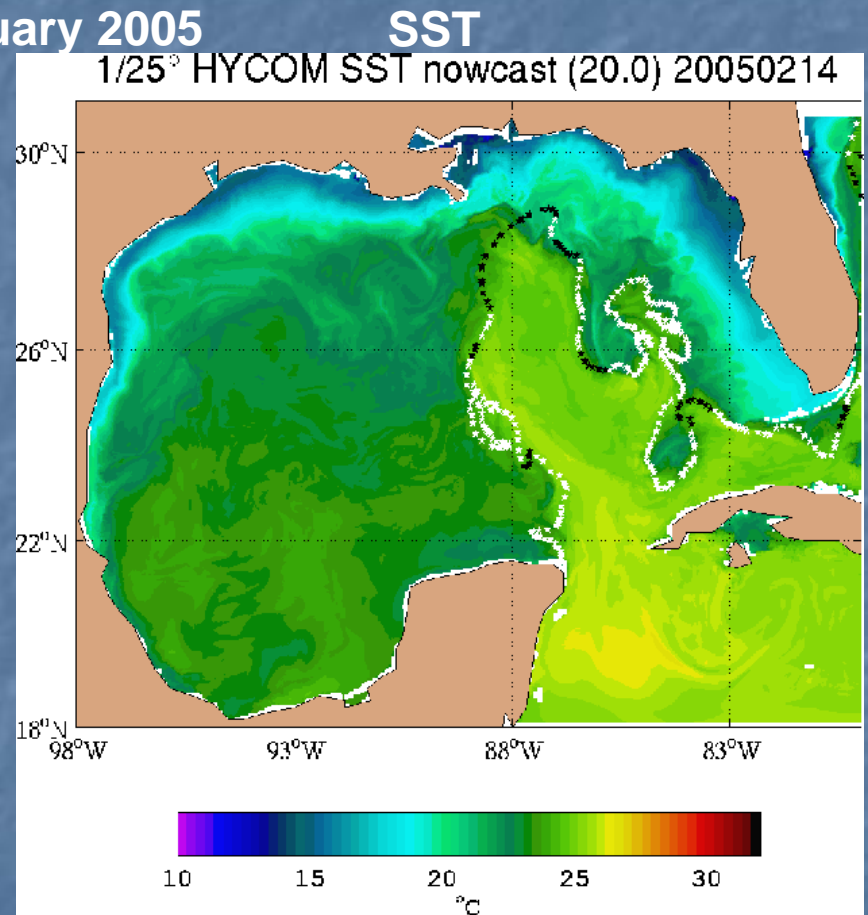
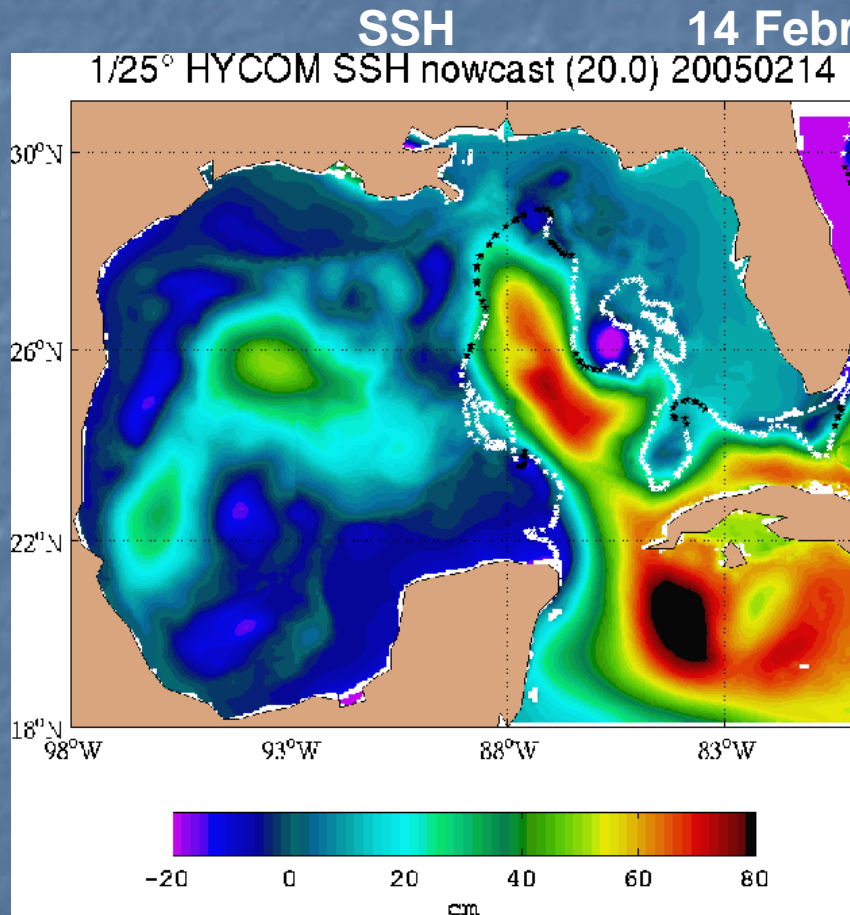
1/25° GULF OF MEXICO HYCOM CONFIGURATION

- Horizontal grid: 1/25° (517 x 349 grid points, 3.5 km spacing on average)
- 18°N to 31°N
- 20 vertical coordinates
- Bathymetry: real coastline (minimum depth 2m)
- Surface forcing from FNMOC/NOGAPS
- Monthly river runoff
- Nested Boundary:
relaxation to the 1/12° Atlantic HYCOM climatological T, S, U and V along open boundary

1/25° Gulf of Mexico HYCOM

Hindcast started 2 September 2003

[webpage](#)



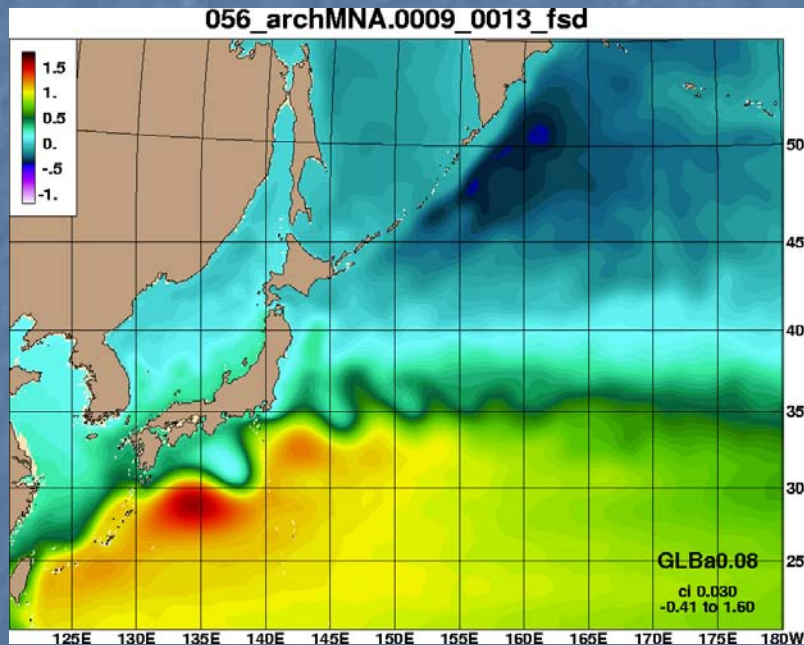
HYCOM nowcast SSH with the NAVO frontal analysis of MCSST observations (white/black lines, black data > 4 days old)

1/12° Global HYCOM Configuration

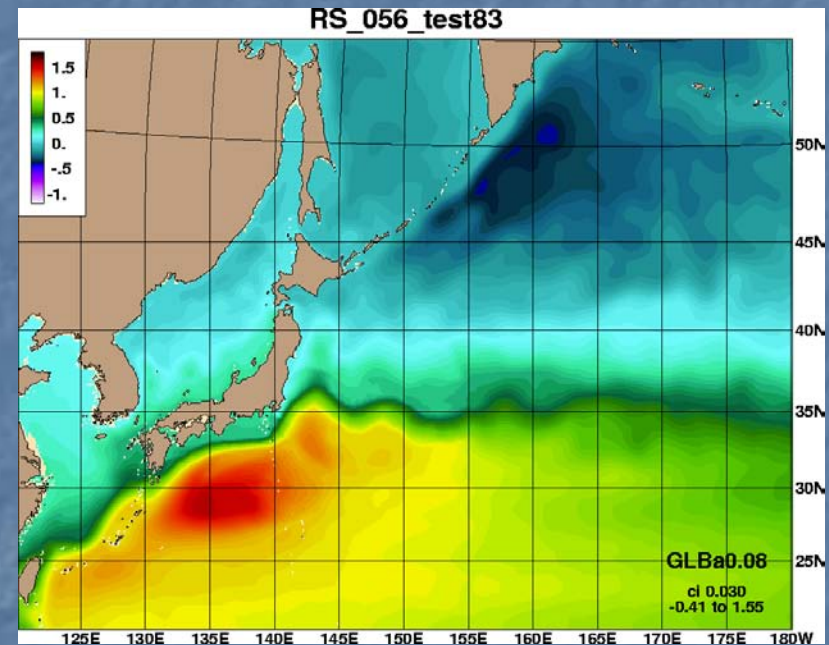
- Horizontal grid: 1/12° equatorial resolution
 - 4500 x 3298 grid points, ~6.5 km spacing on average, ~3.5 km at pole
- Mercator 79°S to 47°N, then Arctic dipole patch
- Vertical coordinate surfaces: 32 for σ_2^*
- GISS mixed layer model
- Thermodynamic (energy loan) sea-ice model
- Surface forcing: wind stress, wind speed, thermal forcing, precipitation, relaxation to climatological SSS
- Monthly river runoff (986 rivers)
- Initialize from January climatology (GDEM3) T and S, then SSS relaxation from PHC 3.0
 - No subsurface relaxation to climatology

1/12° Global HYCOM Mean SSH (05.6)

Original



Rubber sheeted

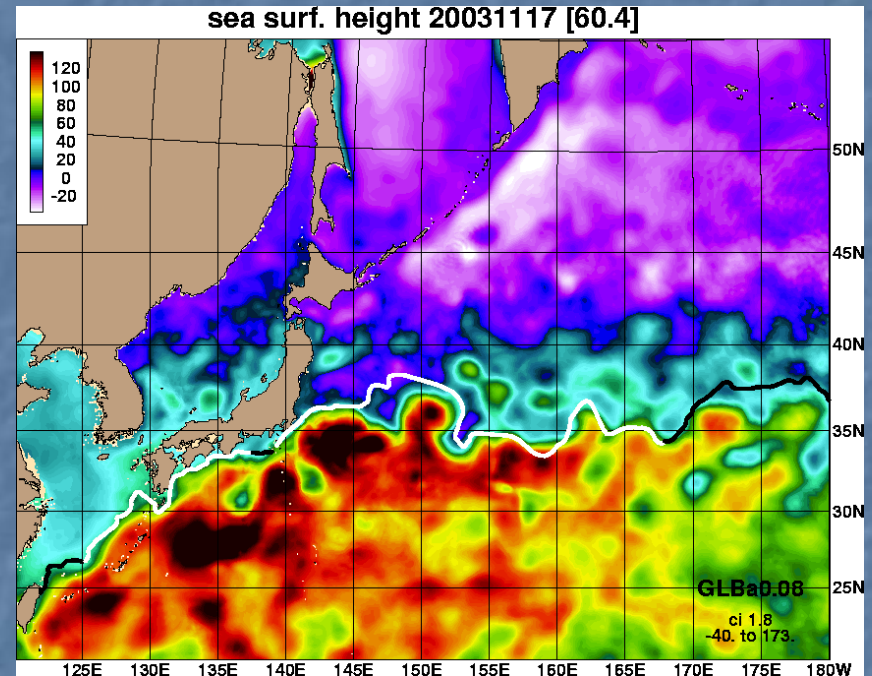
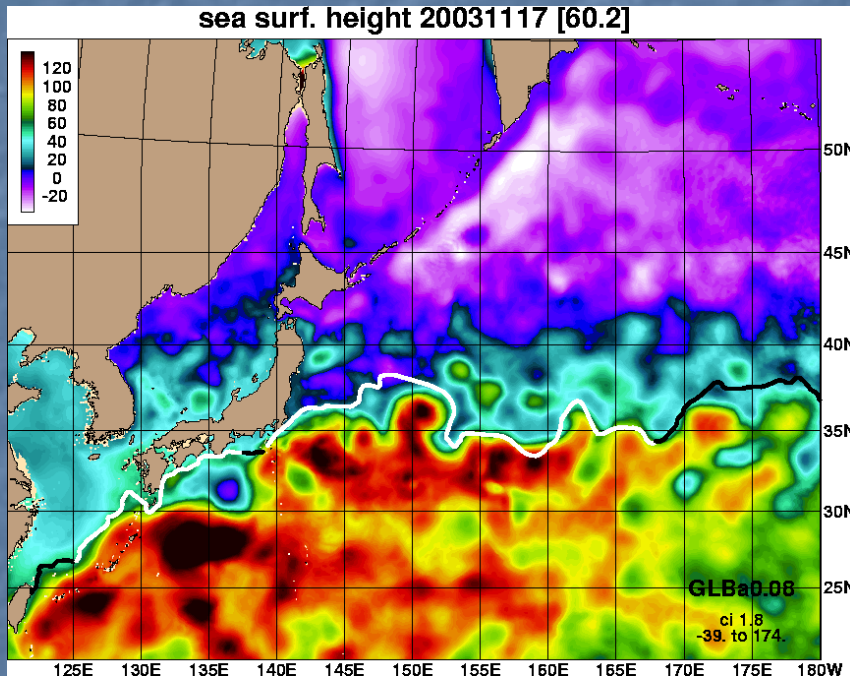


Nicolas Choplain

1/12^o Global HYCOM

Hindcast started 12 November 2003

SSH 17 November 2003

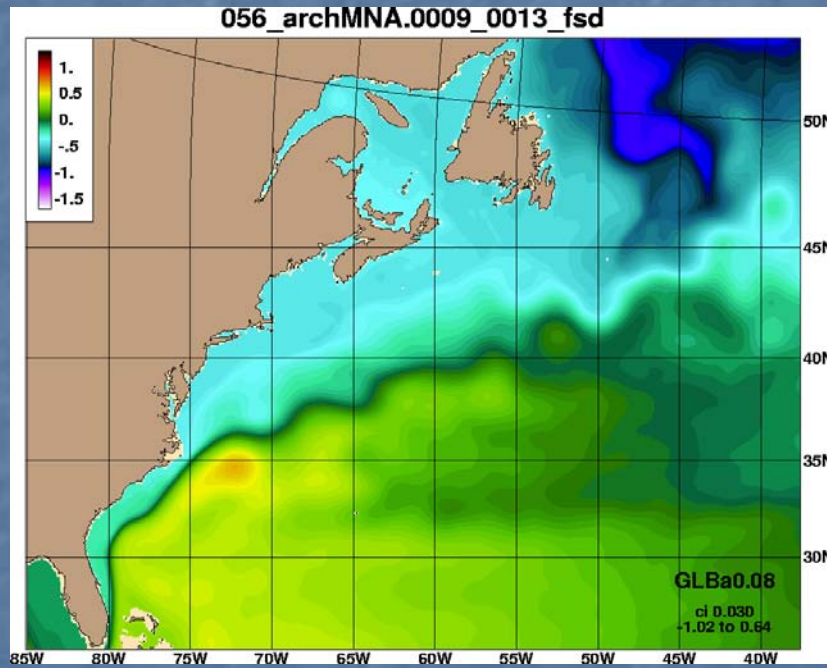


HYCOM nowcast SSH with the NAVO frontal analysis of
MCSST observations (white/black lines, black data > 4 days old)

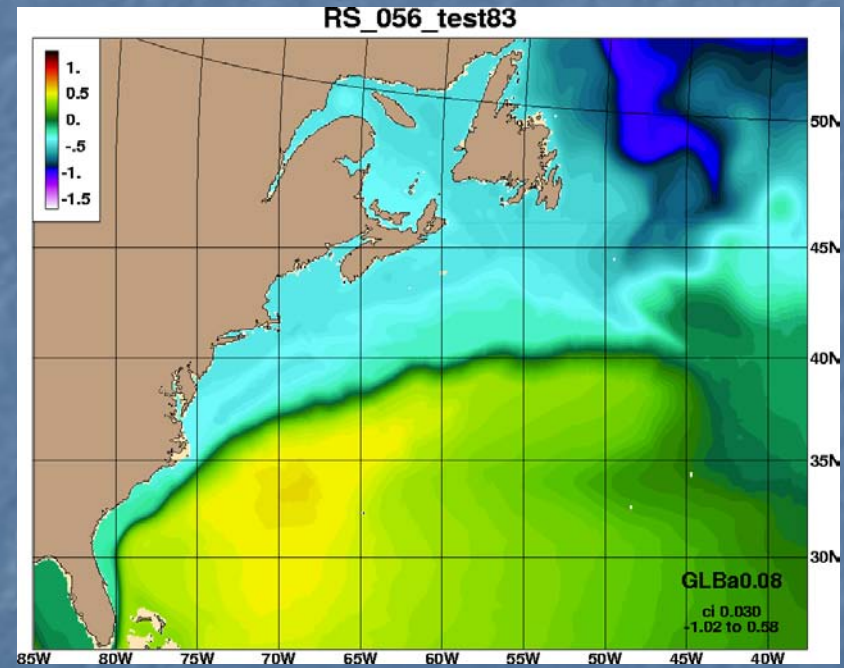
1/12° Global HYCOM

Mean SSH (05.6)

Original



Rubber sheeted

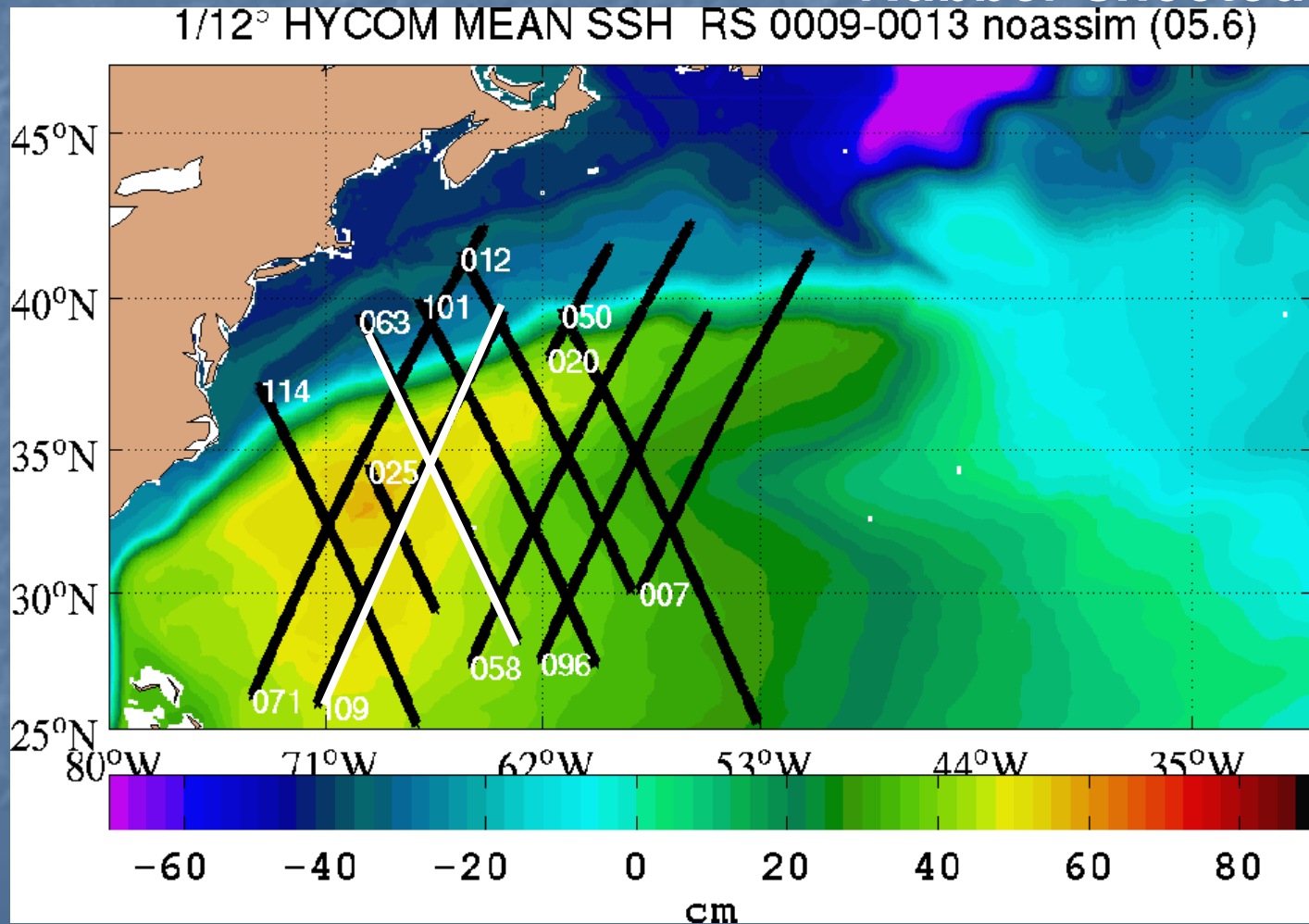


Nicolas Choplain

1/12° Global HYCOM

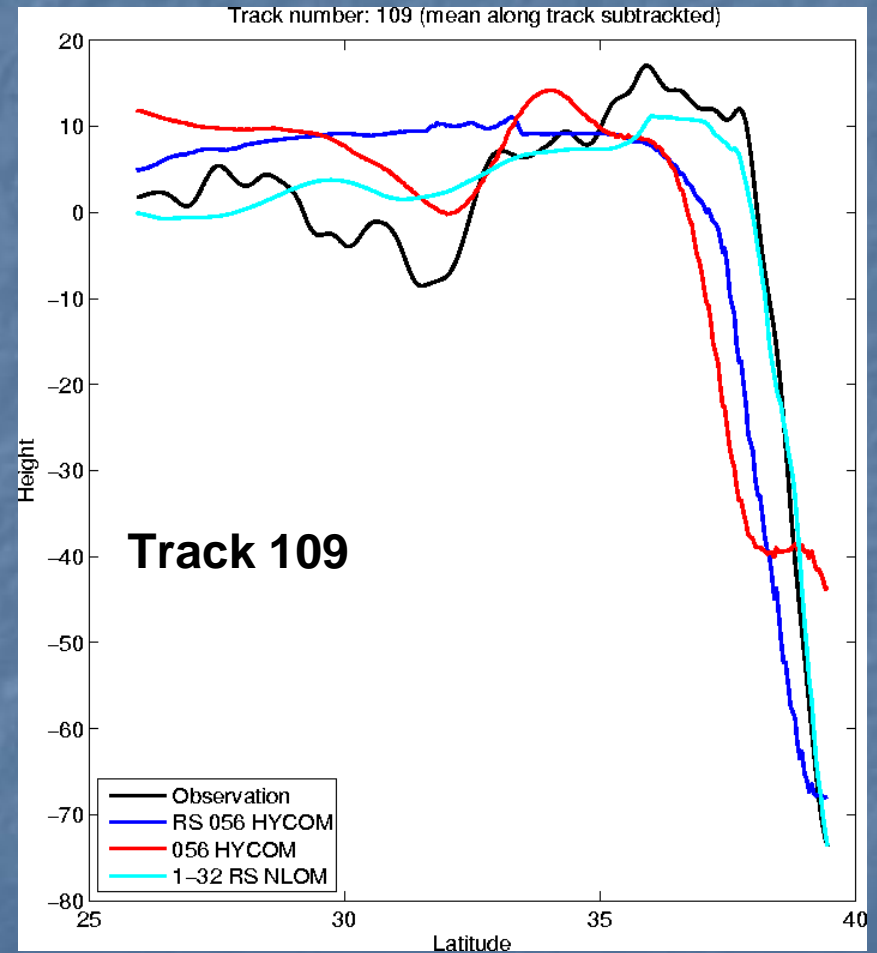
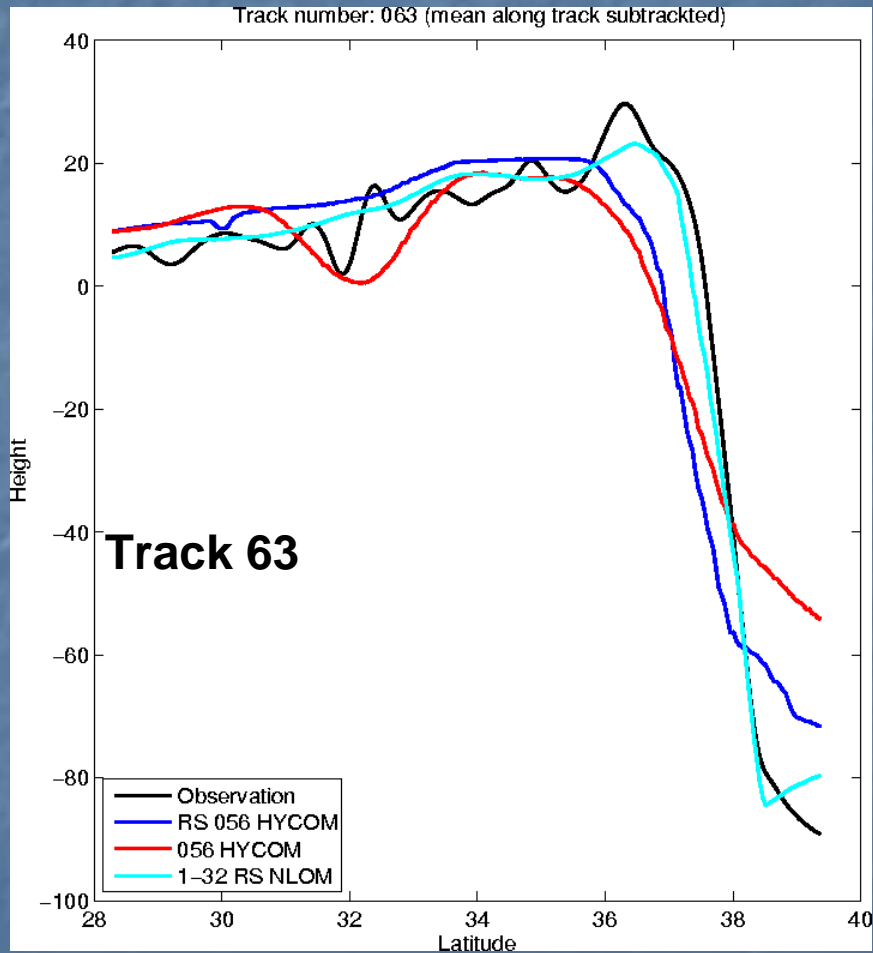
Mean SSH (05.6)

Rubber sheeted



Nicolas Choplain

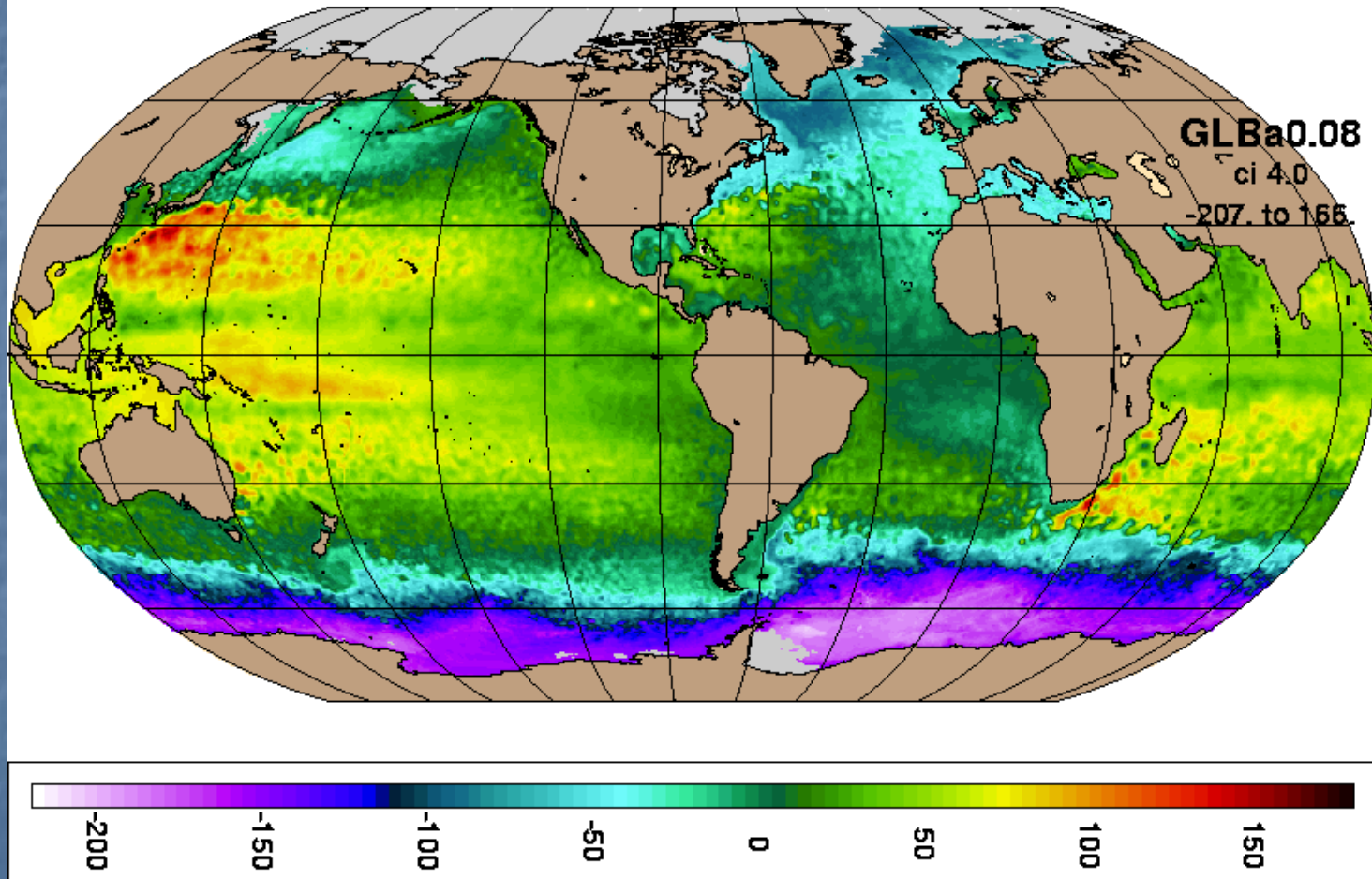
Comparison of mean SSH to mean dynamic topography from XBTs



1/12° Global HYCOM

Hindcast started 12 November 2003

SSH date: Feb 25, 2004

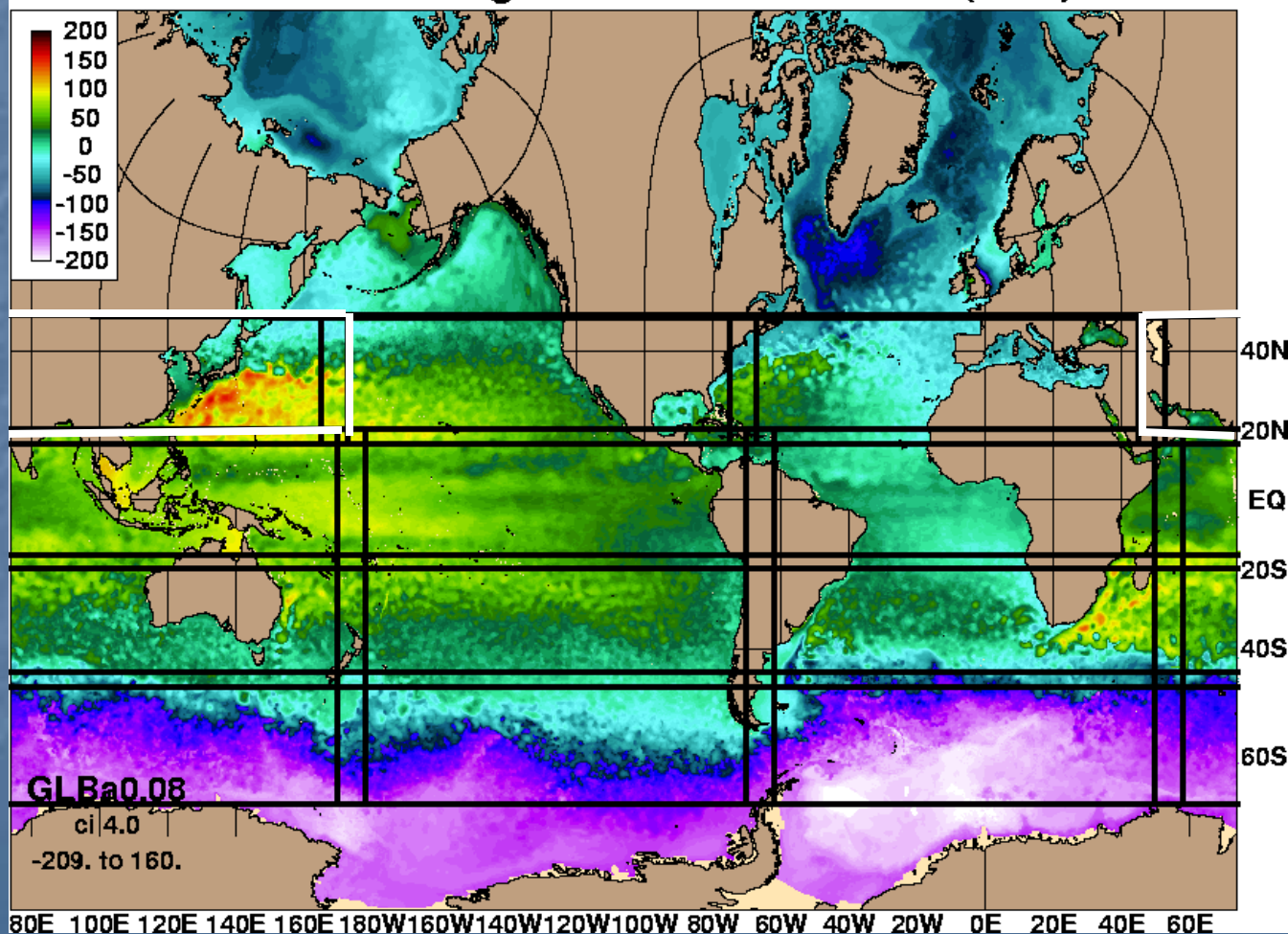


1/12° Global HYCOM

Hindcast started 12 November 2003

SSH 12 November 2003

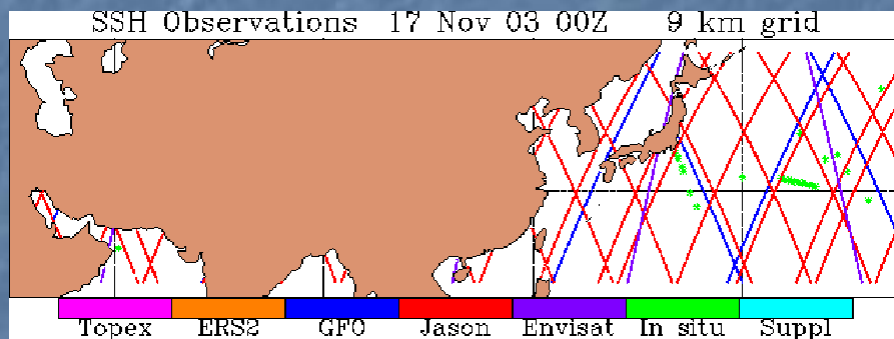
sea surface height 30 November 2003 (60.4)



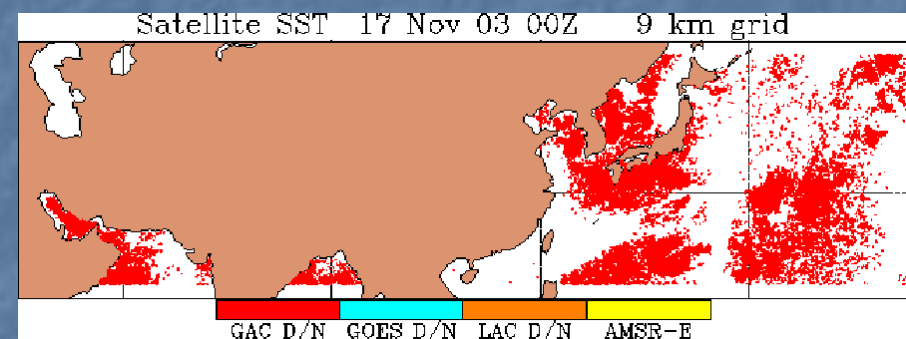
1/12° Global HYCOM

NCODA observations 17 November 2003

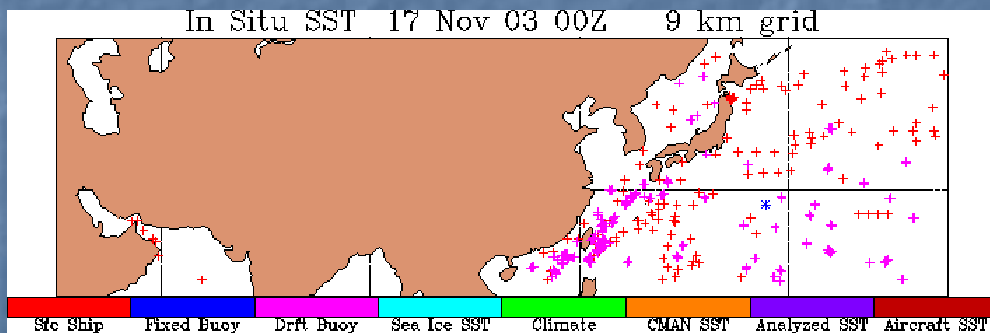
SSH



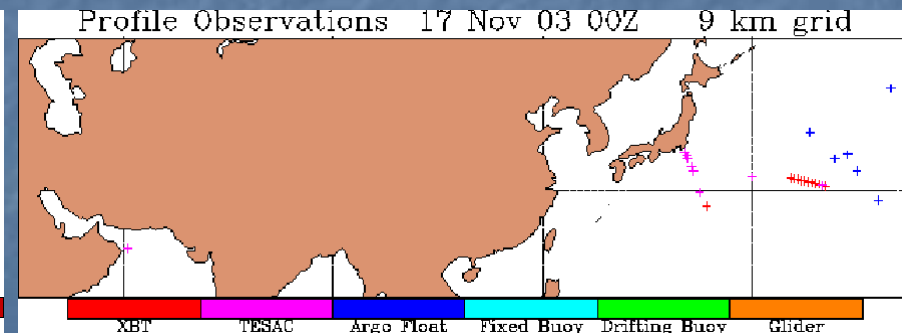
SST



In situ SST



Profiles

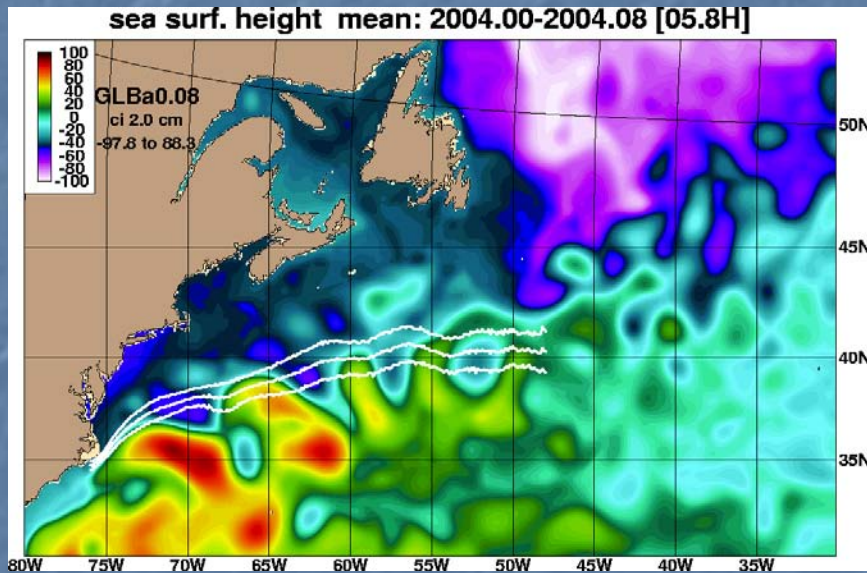


1/12° Global HYCOM

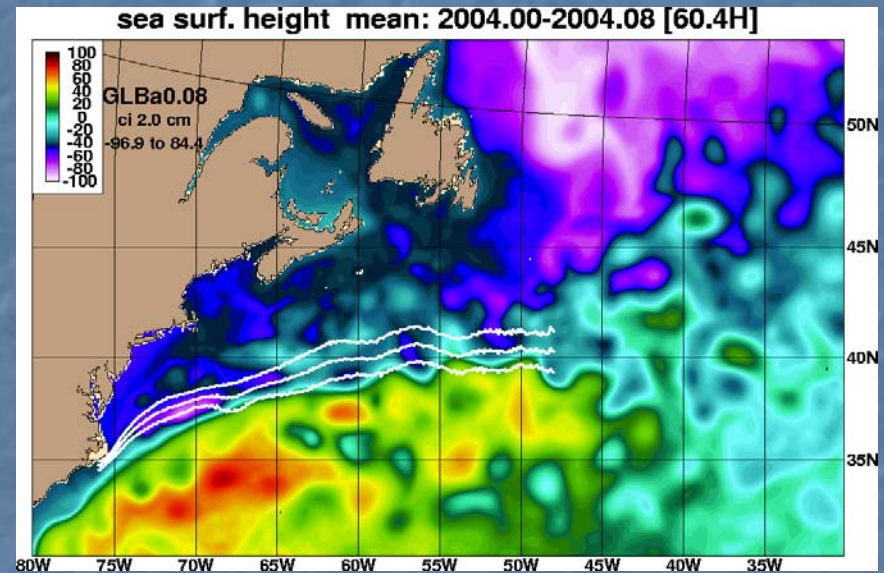
Hindcast started 12 November 2003

Mean SSH January 2004

No assimilation



Assimilation



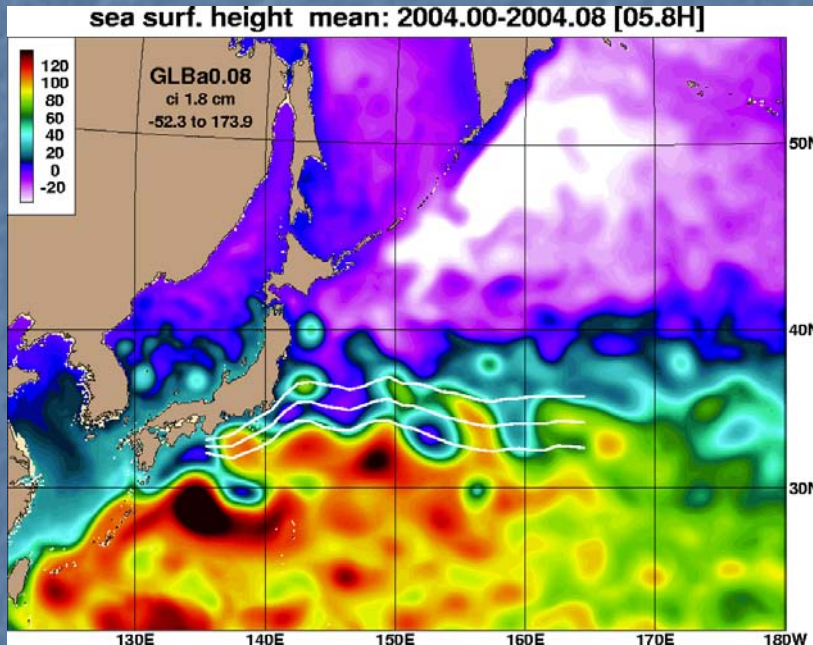
HYCOM mean SSH with the mean pathway of the Gulf Stream ± 1 stdv

1/12^o Global HYCOM

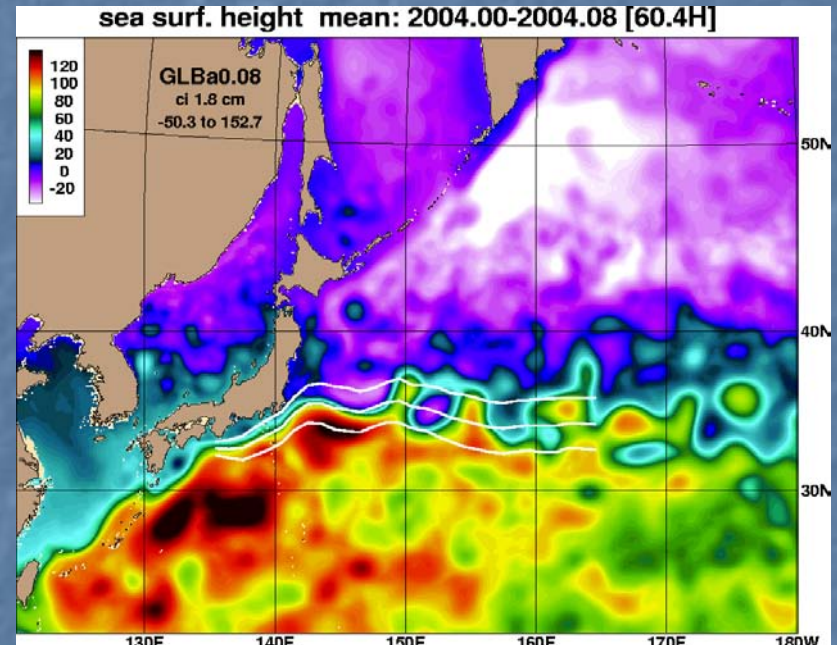
Hindcast started 12 November 2003

Mean SSH January 2004

No assimilation



Assimilation

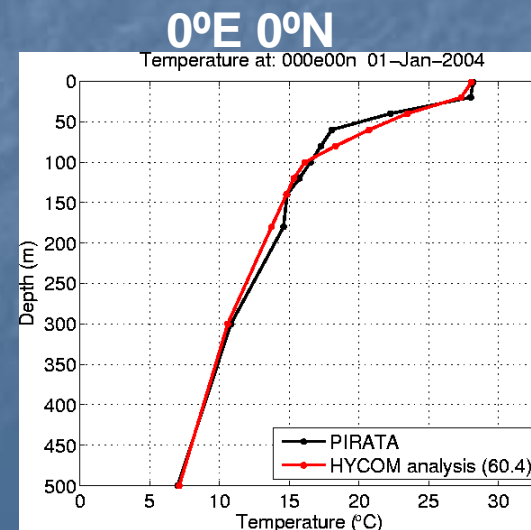
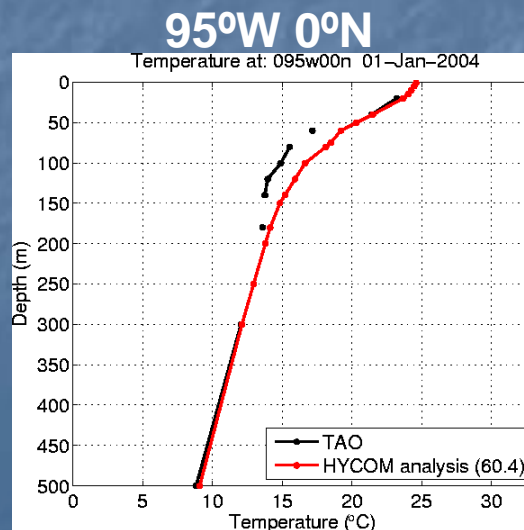
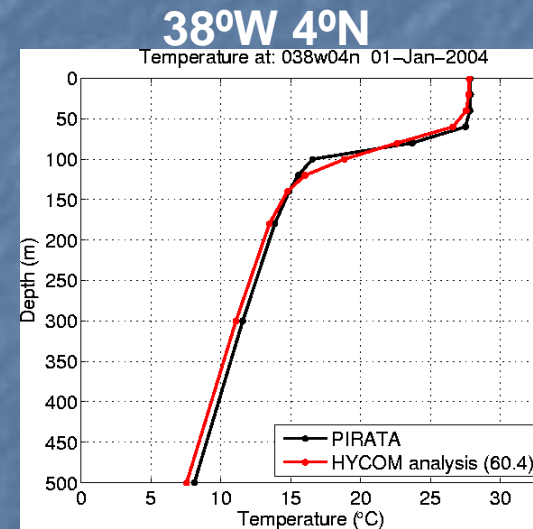
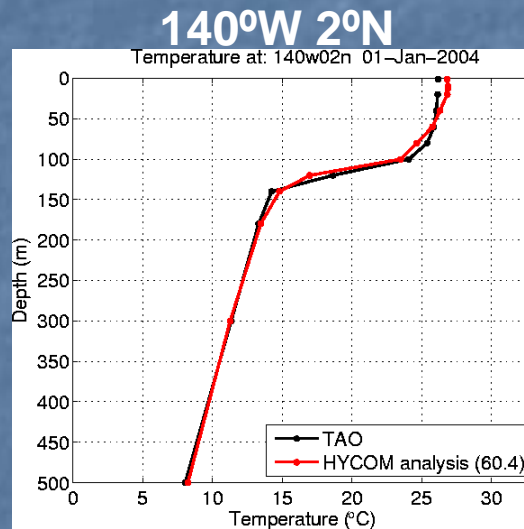


HYCOM mean SSH with the mean pathway of the Kuroshio ± 1 stdv

1/12° Global HYCOM

Hindcast started 12 November 2003

January 2004



Future

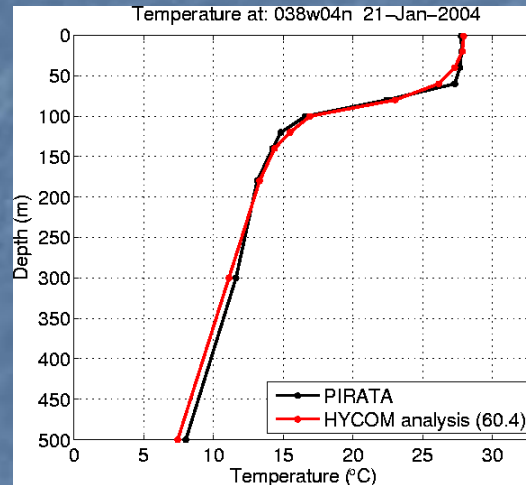
- **Update rubber sheeted mean SSH (in the Gulf Stream region)**
- **Continue present run (to real time)**
- **Include rest of domain in assimilation**
- **Test assimilation of ice concentration in the Bering Sea**

1/12° Global/Atlantic HYCOM

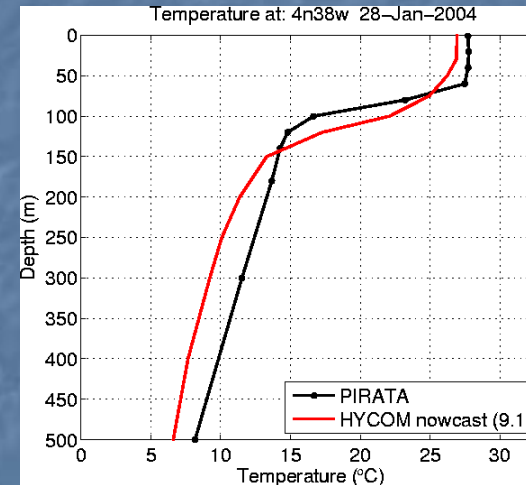
February 2004

38°W 4°N

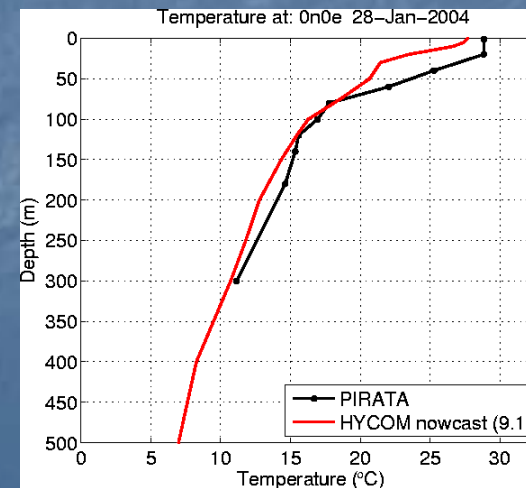
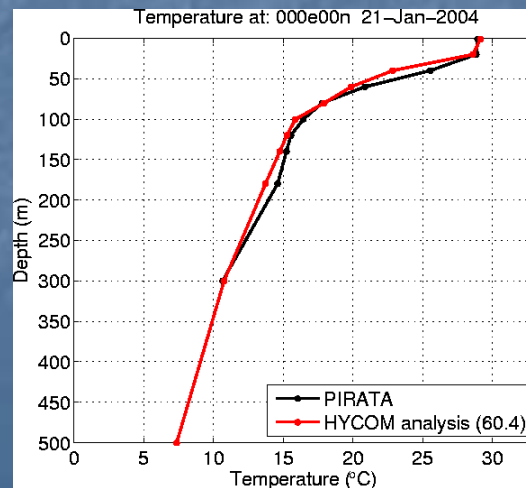
1/12° Global HYCOM



1/12° Atlantic HYCOM



0°E 0°N



END